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Interferometric optical filters utilizing metal patterns on free-standing thin substrates.

A, Ksendzov, R. W. Fathauer, P.M. Maker, R. Muller, W.T. Pike, and '1'. George.

Center for Space Microelectronics Technology, Jet Propulsion Laboratory, California Institute of Technology, Pasadena, CA 91109

Abstract

A new technology for infrared optical filters is presented. We have produced a bandpass filter consisting of a thin (12 μm) Si wafer with cross-shaped metal patterns deposited on both sides. The crosses. with 6 μm arms, have been formed by direct-write electron-bcm lithography on 1000 A Al film. The filter is mounted on a 0,4 mm thick Si frame with 0.25 cm^2 window, but it also can be bonded to detectors or arrays so that the filter and the detector temperature are the same. Due to the high index of refraction in Si, this filter is more tolerant to converging beams than interferometric filters made of metal meshes stretched in air that have been reported previously.

When placed into an F3 converging beam, the resulting filter has a bandpass characteristic centered at 70 μm wavelength with width at haif maximum $\Delta\lambda/\lambda$ = **7°/0.** The transmission maximum is 44%. Extension of the operation to shorter wavelength and narrowing of the bandwidth can be achieved by choosing different thicknesses of Si substrate and changing the size of the cross pattern. However, this will lead to lower maximum transmission due to absorption in the metal. We will discuss these performance tradeoffs anti techniques to avoid them by minimizing absorption in the metal. Performance constraints due to electron-beam lithography limitations aiso will be discussed.